



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/624,420	07/22/2003	Michael Friedemann	2000.108100	7246

23720 7590 06/08/2005

WILLIAMS, MORGAN & AMERSON, P.C.  
10333 RICHMOND, SUITE 1100  
HOUSTON, TX 77042

EXAMINER

VERSTEEG, STEVEN H

ART UNIT PAPER NUMBER

1753

DATE MAILED: 06/08/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/624,420

Applicant(s)

FRIEDEMANN ET AL.

Examiner

Steven H. VerSteeg

Art Unit

1753

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 28 April 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1,4-14 and 16-23 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 14 and 16-23 is/are allowed.
- 6) ☒ Claim(s) 1,4-9,11 and 13 is/are rejected.
- 7) ☒ Claim(s) 10 and 12 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 July 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1, 4-9, 11, and 13 are rejected under 35 U.S.C. 102(e) as being anticipated by US 2004/0134769 A1 to Wang et al. (Wang).

3. For claim 1, Applicant requires a method of forming a barrier layer, comprising:  
depositing a first layer of conductive material comprising said barrier layer onto a substrate having formed therein an opening in a sputter deposition atmosphere having a first state with a pressure of a first value and a bias power of a first value for accelerating target ions towards said substrate, wherein a bias voltage and a pressure of said deposition atmosphere in said first state is selected so as to obtain a thickness of said first layer that is greater at an upper portion of said opening as compared to a bottom portion of said opening; establishing a second state for said sputter deposition atmosphere by increasing at least one of said bias power and said pressure to a second value, wherein a bias voltage and a pressure of said deposition atmosphere in said second state is selected so as to obtain a thickness of said second layer that is greater at a bottom portion of said opening as compared to a top portion of said opening; and depositing a second layer of conductive material comprising said barrier layer in said sputter deposition atmosphere, said

Art Unit: 1753

sputter deposition atmosphere being in said second state. In claims 8 and 9, Applicant indicates that the material that is deposited can be tantalum.

4. Wang discloses depositing a layer of tantalum [0011] as layer 30 onto a substrate in two steps. The first step involves using a low bias state so that the deposited layer is small at the lower sidewall and bottom of the via hole and then using a high biasing state so that more is deposited in the bottom of the via [0055]. Thus, the first state has a lower bias power than the second biasing state. Also, as Applicant claims that the barrier material deposited can be tantalum, the fact that Wang deposits tantalum meets the limitations.

5. For claim 4, Applicant requires the pressure in the first state to be approximately 1-5 mTorr. For claim 6, Applicant requires the pressure in the second state to be higher than approximately 8 mTorr. The pressure used for both deposition states is 0.2-0.3 mTorr, which is considered to be about 1 mTorr, and about 8 mTorr [0085].

6. For claim 5, Applicant requires the bias power for the first state to be approximately 0-300 watts. For claim 7, Applicant requires the bias power for the second state to be approximately equal to or higher than 400 watts. Wang discloses the low bias to be about 50 watts and the high bias to be about 800-1200 watts [0085].

7. For claim 11, Applicant requires the material composition of the deposition atmosphere in the first state to be substantially the same as that in the second state. For claim 13, Applicant requires supplying a precursor gas during at least a part of at least one of the first and second states. The sputtering occurs in the presence of hydrogen gas [0087] and also argon [0083], both of which can be considered precursor gases within the claim requirements. As to the same material, tantalum is deposited in both steps.

***Response to Amendment***

8. The objection to the drawings presented in the office action mailed March 31, 2005 is withdrawn in light of the amendment.

9. The 102(e) rejection of claims 2, 3, 10, 12, and 17-23 over Wang presented in the office action mailed March 31, 2005 is withdrawn in light of the amendment, but the rejection of claims 1, 4-9, 11, and 13 stands.

10. The 102(e) rejection of claims 1, 6-14, and 16 over Wang II presented in the office action mailed March 31, 2005 is withdrawn in light of the amendment.

11. The 102(b) rejection of claims 1, 6, 8, 9, 11, 13, 14, and 16 over Manabe presented in the office action mailed March 31, 2005 is withdrawn in light of the amendment.

12. The 102(b) rejection of claims 1, 6, 7, 1, and 14 over Wang III presented in the office action mailed March 31, 2005 is withdrawn in light of the amendment.

***Allowable Subject Matter***

13. Claims 14 and 16-23 are allowed.

14. Claims 10 and 12 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

15. The following is a statement of reasons for the indication of allowable subject matter: it is neither anticipated nor obvious over the prior art of record to have a method of forming a barrier layer as claimed by Applicant in claims 10 or 17.

Art Unit: 1753

16. Neither Wang nor Wang II nor Wang III nor Manabe disclose increasing both the pressure and the bias power in the second step of a barrier layer formation nor do the references disclose different materials for each step of the barrier layer formation.

***Response to Arguments***

17. Applicant's arguments filed April 28, 2005 have been fully considered but they are not persuasive.

18. Applicant has argued that Wang does not anticipate or render obvious claim 1 because Wang is not forming a barrier layer, but rather is forming a copper layer. I disagree. As noted above, Wang does indeed teach a two-step deposition of tantalum. As you have claimed tantalum to be one of the materials that is considered to be the barrier layer (see claims 8 and 9), it therefore stands to reason that the tantalum layers deposited in Wang are the same.

19. Applicant has then argued that the first step of Wang fills the vias and the second step fills the trench above the layer. I disagree. When you look at the new passages that I have cited in Wang, which was necessitated by your amendment, you will see that the barrier layer 30 that is formed does not fill the via (see Figures 7 and 8). Also, Wang shows in Figure 7 that more material is deposited at the top of the via in the first deposition and then in Figure 8 shows that more material is deposited lower in the via than at the top in the second deposition.

***General Information***

For general status inquiries on applications not having received a first action on the merits, please contact the Technology Center 1700 receptionist at (571) 272-1700.

Art Unit: 1753

For inquiries involving Recovery of lost papers & cases, sending out missing papers, resetting shortened statutory periods, or for restarting the shortened statutory period for response, please contact Denis Boyd at (571) 272-0992.

For general inquiries such as fees, hours of operation, and employee location, please contact the Technology Center 1700 receptionist at (571) 272-1300.

### ***Conclusion***

20. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

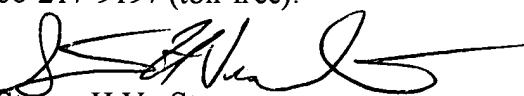
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven H. VerSteeg whose telephone number is (571) 272-1348. The examiner can normally be reached on Mon - Thurs (6:30 AM - 5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 1753

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Steven H VerSteeg  
Primary Examiner  
Art Unit 1753

shv

June 4, 2005